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Biology of *Helicoverpa armigera* (Hubner) on different host plants

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Abstract

The laboratory experiments were conducted to study the biology of *H. armigera* (Hubner) on different host plants viz., soybean, sunflower, sorghum and maize at the Department of Agricultural Entomology, College of Agriculture, Latur during 2015-2016. The results obtained during the course of investigations shows the shortest larval duration (18.87 days) and highest growth index (3.65) was observed in the case of those larvae of *H. armigera* which were reared on maize followed by sorghum (19.52 days and 3.29), sunflower (20.54 days and 2.80) and soybean (22.20 days and 2.09). Significantly the highest adult emergence of *H. armigera* to the tune of 74.80% was observed in the case of those larvae which were reared on maize followed by sorghum (71.60%), sunflower (69.80%) and soybean (65.60%). The significantly lowest developmental period of *H. armigera* to the extent of 35.91 days was recorded on maize. The female *H. armigera* laid significantly highest eggs (757.20) when its immature stage fed on maize followed by sorghum (728.60), sunflower (633.60), while its egg laying was significantly lowest (453.19) on soybean.

Keywords: *Helicoverpa armigera*, host plants, biology, soybean

Introduction

Helicoverpa armigera (Hubner) (Lepidoptera: Noctuidae) is a polyphagous insect-pest which attacks about 181 species of plants belonging to 45 families in India. However, it prefers to feed more on cotton, pulses, vegetables and oilseeds. In the agriculturally diverse ecosystem like India, the adaptive advantage for better survival helps this insect species to thrive on diverse host plants and thereby emerging prevalent throughout the country.

Helicoverpa armigera (Hubner) (Lepidoptera: Noctuidae) is one of the destructive polyphagous pests in the world and widely distributed throughout India on many crops. It is reported to feed on 17 host plants in Rajasthan (Srivastava *et al.*, 2002) [14], 6 host plants in Pantnagar and Manipur (Devi and Singh, 2001) [5], 21 host plants in Punjab and 9 host plants in Australia. There are 60 cultivated species and 67 other species which serve as host plants for *H. armigera*. The wide host range allows the pest to breed throughout the year in India leading to extensive and continued damage and it had become India's major agricultural pest (Ragupathy *et al.*, 2003) [12]. Larvae of head or capitulum borer (*H. armigera*) feed on capitulum or seeds of sunflower and caused yield loss to the tune of 20 to 25% at normal and 40 to 45% during severe infestation (Ranasingh and Mahalik, 2008) [13]. Sunflower is an important oilseed crop grown all over the tropical and sub-tropical parts of the world. The larvae of *H. armigera* were found to feed on more than 50% maturing sunflower seeds. Sorghum is one of the main staple foods for the world's poorest and most food insecure people. It is known to be cultivated as food grain in Africa and Asia. Soybean is considered as pulse crop but due to high oil content and greater response to applied nitrogen, now it is placed in oilseed category. Presently soybean contributes 43% to the total oilseeds and 25% to the total oil production in the country. Soybean serves as host for more than 50 insect-pests in India. However, twelve insect-pests were reported to feed on soybean in Marathwada.

Material and Methods

The investigations were carried out to study the growth and development of *Helicoverpa armigera* (Hubner) on different host plants viz., soybean, sunflower, sorghum and maize at the Department of Agricultural Entomology, College of Agriculture, Latur during 2015-16.

Biology of *Helicoverpa armigera* (Hubner) on different host plants: The studies on biology of *H. armigera* (Hubner) were carried out on four different host plants viz., soybean, sunflower,

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sorghum and maize in a completely randomized design replicated five times. Four different host plants were sown in a plot size of 5 m x 5 m each with 1 m pathway between two plots at the planting distance of 60 cm x 20 cm, 45 cm x 15 cm, 60 cm x 25 cm and 45 cm x 15 cm of soybean, sunflower, sorghum and maize, respectively at the farm of College of Agriculture, Latur during 2015-16.

One hundred freshly laid eggs of *H. armigera* were obtained from the oviposition cage in order to study the biology on each of four different host plants. The eggs were transferred to moist tissue paper kept in petriplates with a total of 20 eggs in each petriplate as one replication. The observations on incubation period and % egg hatch were recorded. The newly hatched larvae were reared individually in a clean plastic container on plant parts of four different host plants under study as food substrate. The developing green pods of soybean, part of capitulum of sunflower and immature grains of sorghum and maize were used as plant parts to serve as food substrate of *H. armigera*. The observations on larval duration, % larvae pupated, pre-pupal and pupal durations, % adult emergence and life-cycle duration of male and female moths were recorded on respective plant parts of four different host plants. The growth index was calculated by using Howes (1953) formula.

$$\text{Growth index} = \frac{\text{Per cent larvae pupated}}{\text{Mean larval duration (days)}}$$

Results and Discussion

The laboratory studies on biology of *H. armigera* on different host plants viz., soybean, sunflower, sorghum and maize. The incubation period of *H. armigera* was varied significantly when reared on different host plants. However, incubation period of *H. armigera* was highest on soybean (3.20 days) followed by sunflower (3.10 days), maize (2.69 days) and sorghum (2.54 days). The incubation period of *H. armigera* on first two and latter two host plants were at par with each other. Significantly the highest egg hatch to the extent of 90.00% was observed on sunflower and maize followed by sorghum (89.00%) and soybean (87.00%) (Table 1).

It seems from the present investigation that the incubation period of *H. armigera* was extended when reared on soybean. The incubation period of *H. armigera* was reported to be 3 days each on lucerne and sunflower (Patel and Koshiya, 1998 and 1998b)^[9], 2.67±0.33 and 3.50±0.35 days on Jwalamukhi and PSFH-67 cultivars of sunflower (Sharma and Singh, 2001)^[10].

Table 1: The mean incubation period, % egg hatch, larval duration, % pupation and growth index of *H. armigera* on different host plants

Name of the host plants	Mean incubation period (days)	Percent egg hatch	Mean larval duration (days)	% larvae pupated	Growth Index
Soybean	3.20	87 (69.55)	22.20	46.46 (42.96)	2.09
Sunflower	3.10	90 (76.13)	20.54	57.46 (49.29)	2.80
Sorghum	2.54	89 (72.02)	19.52	64.70 (53.55)	3.29
Maize	2.69	90 (75.05)	18.87	69.50 (56.50)	3.65
S.E ±	0.08	0.98	0.37	0.87	0.09
C.D at 5%	0.24	2.90	1.09	2.62	0.26
C.V. (%)	6.56	2.41	4.03	3.27	6.55

Figures in parentheses indicate arcsine transformed values.

Larva: It is evident from Table 1 that significantly the shortest mean larval duration of *H. armigera* to the extent of 18.87 days was observed on maize followed by 19.52 days on sorghum, 20.54 days on sunflower and 22.20 days on soybean. This indicates that the larval period of *H. armigera* was lengthened on soybean and shortened on maize. The larval period of *H. armigera* was reported to be 17.4 days on maize and 18.7 days on sunflower (Pretorius, 1976)^[12], 16.42 days on maize and 19.00 days on sorghum (Bantewad and

Sarode, 2000)^[3], and 18.30 days on hybrid sweet corn (Jha *et al.*, 2012)^[4].

The significantly lowest pupation of *H. armigera* was recorded on soybean (46.46%) followed by sunflower (57.46%), sorghum (64.70%) and maize (69.50%). The growth index values varied from 2.09 to 3.65. The significantly highest growth index was observed in the case of larvae fed on maize (3.65) over sorghum (3.29), sunflower (2.80) and soybean (2.09 days).

Table 2: The mean larval instars duration of *H. armigera* on different host plants

Name of the host plants	Larval instars						Total	Mean
	I	II	III	IV	V	VI		
Soybean	3.22	3.60	3.50	4.05	4.10	3.73	22.20	3.70
Sunflower	3.18	2.90	3.41	3.40	4.29	3.36	20.54	3.42
Sorghum	3.39	3.13	2.98	3.39	3.37	3.26	19.52	3.25
Maize	3.24	3.09	3.18	3.16	3.05	3.15	18.87	3.15
S.E ±	0.40	0.088	0.10	0.08	0.12	0.07	-	-
C.D. at 5%	0.12	0.26	0.30	0.24	0.36	0.19	-	-
C.V. (%)	5.84	6.12	6.85	5.05	7.28	4.08	-	-

It is evident from Table 2 that the *H. armigera* passed through six larval instars when reared on different host plants. The duration of I, II, III, IV, V and VI larval instars ranged from 3.18 to 3.39, 2.90 to 3.60, 2.98 to 3.50, 3.16 to 4.05, 3.05 to 4.29 and 3.15 to 3.73 days, respectively on different host plants under investigation. The mean larval instar durations

was lowest on maize (3.15 days) followed by sorghum (3.25 days), sunflower (3.42 days) and soybean (3.70 days). Jha *et al.* (2012)^[4] reported that the average first, second, third, fourth, fifth and sixth larval instar duration was 2.08, 3.77, 2.53, 4.22, 5.32 and 4.71 days, respectively on hybrid sweet corn.

Pupa

The pre-pupal and pupal duration, % adult emergence and

total developmental period of *H. armigera* on different host plants are presented in Table 3.

Table 3: The mean pre-pupal and pupal duration, % adult emergence and total developmental period of *H. armigera* on different host plants

Name of the Host plants	Pre-pupal duration (days)	Pupal duration (days)	% adult emergence	Total developmental period (days)
Soybean	2.31	15.87	65.60 (54.10)	43.42
Sunflower	2.07	14.55	69.80 (56.67)	40.46
Sorghum	1.72	13.89	71.60 (57.81)	37.66
Maize	1.55	12.76	74.80 (59.89)	35.91
S.E. ±	0.03	0.28	1.18	0.52
C.D. at 5%	0.08	0.83	3.55	1.55
C.V. (%)	3.21	4.32	3.76	2.93

Figures in parentheses indicate arcsine transformed values.

The significantly shortest mean pre-pupal and pupal durations of *H. armigera* to the extent of 1.55 and 12.76 days, respectively were recorded on maize. While, these durations were highest on soybean (2.31 and 15.87 days). Hamed and Nadeem, (2008) [6] reported the pupal period of *H. armigera* was 12.95 days on maize hybrid SC700 and 13.35 days on hybrid DC370 (Arghand, 2011) [1], 14.6, 14.53, 14.97, 14.25, 14.74, 14.71, 13.99, 15.81, 14.50, 14.98 and 14.68 on carnation, pigeonpea, bathua, chickpea, sorghum, mothbean, tomato, capsule of castor, cotton, sonchus and cowpea, respectively (Yadav *et al.*, 2015) [15].

The significantly highest adult emergence was observed in the case of maize (74.80%) followed by sorghum (71.60%), sunflower (69.80%) and soybean (65.60%) (Table 3). However, the adult emergence on sorghum and maize and sunflower and soybean were at par each other. This indicates that the maize was suitable for emergence of adults.

Total developmental period

The data presented in Table 3 revealed that the mean total developmental period of *H. armigera* was observed to be significantly lowest on maize (35.91 days) as compared to sorghum (37.66 days), sunflower (40.46 days) and soybean (43.42 days). The total developmental period of *H. armigera* ranged from 32.3 to 42.7 days on leaves of cotton cultivars (Balakrishnan *et al.*, 2004) [2].

Table 4: The mean longevity and life-cycle duration of *H. armigera* on different host plants

Name of the host plants	Longevity (days)		Life-cycle duration (days)	
	Male	Female	Male	Female
Soybean	9.32	10.65	52.85	54.47
Sunflower	10.69	12.47	51.15	52.93
Sorghum	09.40	10.87	47.06	49.80
Maize	10.71	12.69	46.25	48.08
S.E ±	0.19	0.18	0.48	0.52
C.D at 5%	0.56	0.55	1.45	1.55
C.V. (%)	4.17	3.54	2.20	2.26

The data presented in Table 4 revealed that statistically significant differences were observed in respect of longevity of male and female *H. armigera* when reared on different host plants.

The significantly highest longevity of male and female *H. armigera* was recorded on maize (10.71 and 12.69 days). It was followed by the longevity of male and female on sunflower (10.69 and 12.47 days), sorghum (9.40 and 10.87 days) and soybean (9.32 and 10.65 days). The adult longevity of *H. armigera* was reported to be 9.50, 8.63, 10.92, 10.66,

9.57, 9.68, 9.83 and 9.99 days on pigeonpea leaves, pigeonpea pods, black gram leaves, black gram pods, gram leaves, gram pods, pea leaves and pea pods, respectively. The data on adult longevity of *H. armigera* on different host plants in the present investigation are in good line with the results reported by above mentioned earlier worker.

Significantly the shortest life-cycle duration of male and female *H. armigera* to the extent of 46.25 and 48.08 days was observed on maize followed by life-cycle duration of the male and female *H. armigera* on sorghum (47.06 and 49.80 days) and 51.15 and 52.93 days on sunflower while, it was longest (52.85 and 54.47 days) when reared on soybean.

It indicates from the present investigation on biology of *H. armigera* reared on different host plants that the durations of different life-stages were extremely extended when reared on soybean compared to their durations when reared on sunflower, sorghum and maize. However, adult emergence was adversely affected on soybean as compared to sunflower, sorghum and maize.

The data in respect of mean pre-oviposition and oviposition periods and fecundity of *H. armigera* on different host plants are presented in Table 5.

Table 5: The mean pre-oviposition and oviposition period and fecundity of *H. armigera* on different host plants

Name of the host plant	Pre-oviposition period (days)	Oviposition period (days)	Fecundity/ female
Soybean	2.42	8.89	453.19 (21.26)
Sunflower	2.21	9.16	633.60 (25.16)
Sorghum	2.34	8.94	728.60 (26.60)
Maize	2.06	9.86	757.20 (27.49)
S.E. ±	0.06	0.09	24.03
C.D. at 5%	0.18	0.27	N.S.
C.V. (%)	5.95	2.17	8.35

Figures in parentheses indicate square root transformed values.

It is evident from Table 5 that significantly highest pre-oviposition period of *H. armigera* to the extent of 2.42 days was observed on soybean, followed by 2.34 days on sorghum, 2.21 on sunflower and 2.06 days on maize. However, the significantly highest oviposition period to the tune of 9.86 days was recorded on maize over sunflower (9.16 days), sorghum (8.94 days) and soybean (8.89 days). The results in respect of pre-oviposition and oviposition period of *H. armigera* to the tune of 3.12 and 9.8 days, respectively were also reported by Pandey and Kumar (2007) [8] on chickpea.

Numerically the highest fecundity to the tune of 757.20 eggs per female was recorded on maize followed by sorghum (728.60 eggs per female), sunflower (633.60 eggs per female) while, lowest fecundity was recorded on soybean (453.19

eggs per female). The similar results on egg laying capacity of *H. armigera* to the tune of 731 and 591 eggs on sunflower leaves and maize cobs, respectively were reported by Pretorius (1976)^[11] and 708.4, 784.8, 559, 562.5 and 314.3, respectively on cotton, corn, common bean, tomato and hot pepper (Liu *et al.*, 2004)^[7].

References

1. Arghand A. Comparison of biological parameters and nutritional indices of *Helicoverpa armigera* (Lepidoptera: Noctuidae) on seed of different maize hybrids. *M. Sc. Thesis*. University of Mohaghegh Ardabili, Ardabil, Iran; c2011. p. 77.
2. Balakrishnan NM, Baskaran RK, Mahadevan NR. Development and reproductive potential of *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae) on various plant parts of cotton cultivars/hybrid. *Entomon*. 2004;29(4):305-316.
3. Bantewad SD, Sarode SV. Influence of different hosts on the biology of *Helicoverpa armigera* (Hubner). *Shashpa*. 2000;7(2):133-136.
4. Jha RK, Hsin Chi, Li-Cheng Tang. A comparison of artificial diet and hybrid sweet corn for the rearing of *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae) based on life table characteristics. *Environ. Entomol*. 2012;41(1):30-39.
5. Devi NS, Singh TK. Host range of *Helicoverpa armigera* (Hubner) in Manipur. *J Agril. Sci. Soc. North-East India*. 2001;14(2):195-199.
6. Hamed M, Nadeem S. Rearing of *Helicoverpa armigera* (Hub.) on artificial diets in laboratory. *Pakistan J Zool*. 2008;40(6):447-450.
7. Liu Z, Li D, Gong PY, Wu KJ. Life-table studies of the cotton bollworm, *Helicoverpa armigera* (Hubner) (Lepidoptera, Noctuidae), on different host plants. *Environ. Ent*. 2004;33:1570-1576.
8. Pandey KA, Kumar DB. Studies on biology of chickpea pod borer, *H. armigera* (Hubner) on chickpea, *Indian J Ent*. 2007;4(2):37-46.
9. Patel CC, Koshiya DJ. Life-table and innate capacity of increase of *Helicoverpa armigera* (Hubner) on sunflower, *Res, J Gujarat Agril. Univ*. 1998;24(1):41-48.
10. Sharma M, Singh G. Development of *Helicoverpa armigera* on different varieties of sunflower (*Helianthus annuus*). *Indian J. agric. Sci*. 2001;71(8):538-543.
11. Pretorius LM. Laboratory studies on the developmental reproductive performance of *Helicoverpa armigera* on various food plants. *J Ent. Soc. 5th Africa*. 1976;39:331-343.
12. Ragupathy A, Kranthi K, Singh J, Iquabal A, Wu Y, Russel D. Patterns and magnitude of insecticide resistance levels in India, Pakistan and China. In: *Proceedings of World Cotton Conference 3*. Cape Town, South Africa; c2003. p. 115-129.
13. Ranasingh N, Mahalik JK. Insect-pests management in sunflower. *Orissa Review*; c2008. p. 51-52.
14. Srivastava AK, Nain RP, Sukla A. Survey to record host plants of *Helicoverpa armigera* (Hubner) at Udaipur. *Insect Environ*. 2002;8(4):163-164.
15. Yadav SS, Singh B, Kumar A, Satya V. Laboratory evaluation of host plant suitability for *Helicoverpa armigera* (Hubner) on growth and development. *J Glob. Biosc*. 2015;(4):2044-2051.